

Bunker gear fabric

[Science](#), [Chemistry](#)



Bunker gear or turnout gear is the protective clothing used by a firefighter in fighting fires and during rescue operations. This gear is called turnouts because when not being used, they are kept standing by to be put on swiftly by 'turning out' the pants over the boots. It is a requirement for firefighters to be able to put on all of the gear in no time, and in this set up, all they have to do is to step into the boots and pull the pants up. This solidly insulated gear is worn to shield the firefighter's body from the extreme heat of a fire.

Approximately, structural turnouts will break down at 650°C (1200°F). A full turnout gear may weigh more or less 30kg aside from other extra tools to be carried. It is consisted of " a coat, pants and suspenders, leather or rubber waterproof boots, a hood, a strong helmet with eye protection, gloves, a belt, and SCBA (Self Contained Breathing Apparatus)" (www.sccfd.org). Turnout pants protects the lower part of the firefighter's body. It is made of fire-resistant materials and they are easy to put on with Velcro and snaps.

Turnout pants have side pockets for tools, gloves, and other necessary equipment. In order for the firefighters to be seen at night, these pants also have reflective stripes on the bottom. Turnout coat's outside liner is made of exclusive fire resistant fabrics. The coat has various liners for extra protection. One of these liners acts as a moisture barrier, it prevents outside moisture to reach the firefighter. Another part of the liner protects firefighters from the exposure to thermal heat. Pockets are also available for extra equipment such as gloves, radio, wrenches and other tools.

Around its neck is a Nomex hood. Except for the face, it covers practically the entire head of the firefighter. The turnout boots are made of rubber.

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Aside from steel toe covering, these have a steel shank in sole to protect firefighters from sharp or pointed objects. In order to be put on quickly, these boots have handles at the top. Wearing of this protective gear is a requirement for all firefighters approaching a seat of the fire or entering a hazardous area as stated in the NFPA 1971 Code or the Protective Clothing for Structural Fire Fighting.

Looking back in history, firefighters' garment was consisted of a cotton or wool shirt, heavy wool trousers, and a heavy wool tunic, which was sometimes worn over with rubber slickers. Wool was used because of its ability to protect a firefighter from heat and cold, and also because of its resistance to mild flame and water. Their gloves were the traditional leather gloves for laborers. It was only after the World War II when the standards for firefighter protective gears were issued by a number of organizations like the National Fire Protection Association or the NFPA.

According to the NFPA 1971 Standard on Protective Clothing for Structural Firefighting, turnout gears must be composed of three layers: the outer layer must be made from flame-resistant fabric " that would not be destroyed through charring, separating, or melting when exposed to 500°F for a five-minute period;" the second layer must " prevent moisture from penetrating through to the wearer;" and the third layer must " provide thermal insulation from radiant, conducted, and convective heat" (<http://www.pbs.org>). Firefighters' gloves should also be resistant to heat, flame, liquids, vapor, and sharp objects.

The boots should also withstand flame, puncture, heat, electrical current, and abrasion. Further advancements in firefighters' turnout materials came <https://assignbuster.com/bunker-gear-fabric/>

up during the 80s. The 500°F temperature resistance limit of the outer shell was raised to around 1, 200°F. The other layer also allowed the firefighters to "release moisture from inside the gear," and the material used was a fire-resistant fabric. Being self-extinguishing, this material will not continue to burn once it is out of contact with a fire. Bunker gears are made out of synthetic fibers such as Aramid and Polybenzimidazoles (PBI).

These synthetic fibers are polymers. A polymer is a substance with high molecular weight made up of a large number of smaller molecules. These molecules, called monomers, react together in hundreds, or even millions of times. The properties of the polymers are determined by the molecular shape variations that resulted from the reactions. These could be in the form of long, straight chains or branched. It is through their average molecular weight that their sizes are expressed. Polymers with higher molecular weights have the higher strength. They also usually have high melting or boiling points.

Filaments made of synthetic polymer fibers have excellent strength because these fibers can be prepared with regular structures that allow the chains to pack together tightly. Another advantage of synthetic polymers is that they are stronger and much lighter than steel, making them the choice for bunker gears and bullet proof vests. Aramids are synthetic polyamides, a class of polymer for textile fibers. It has a carbon-based backbone which contains aromatic rings. Fabrics made of aramids are strong and flame resistant even at extreme temperatures because of the stability of the fiber's aromatic structures and their conjugated amide linkages.

Polyamides are manufactured through step-growth polymerization. In this process, " monomers with two reactive ends join to form dimers (two " parts" joined together), then " trimers" (three " parts"), and so on. However, since each of the newly formed oligomers (short chains containing only a few parts) also has two reactive ends, they can join together; so a dimer and a trimer would form a pentamer (five repeating " parts")" (www.fibersource.com). The aramid fibers, on the other hand, are produced through Wet Spinning process.

The fiber-forming materials are dissolved in a solvent, which is usually hydrogen sulfate (H_2SO_4), and spun using a spinneret. Aside from firefighting gears, aramid fabrics are also useful for friction products such as brake pads, clutch pads or seals and gaskets, because synthetic materials made from this fabric does not ignite or melt. Aramid fibers are also flexible, lightweight, resistant to organic solvents and fuels, and good insulators of electricity. Aramids are more popularly known with the names Kevlar and Nomex. The blend of these two aramids is used in manufacturing turnout gears.